Natco

world's finest professional-type

16mm. sound film projector

operating and maintenance manual

model 3030

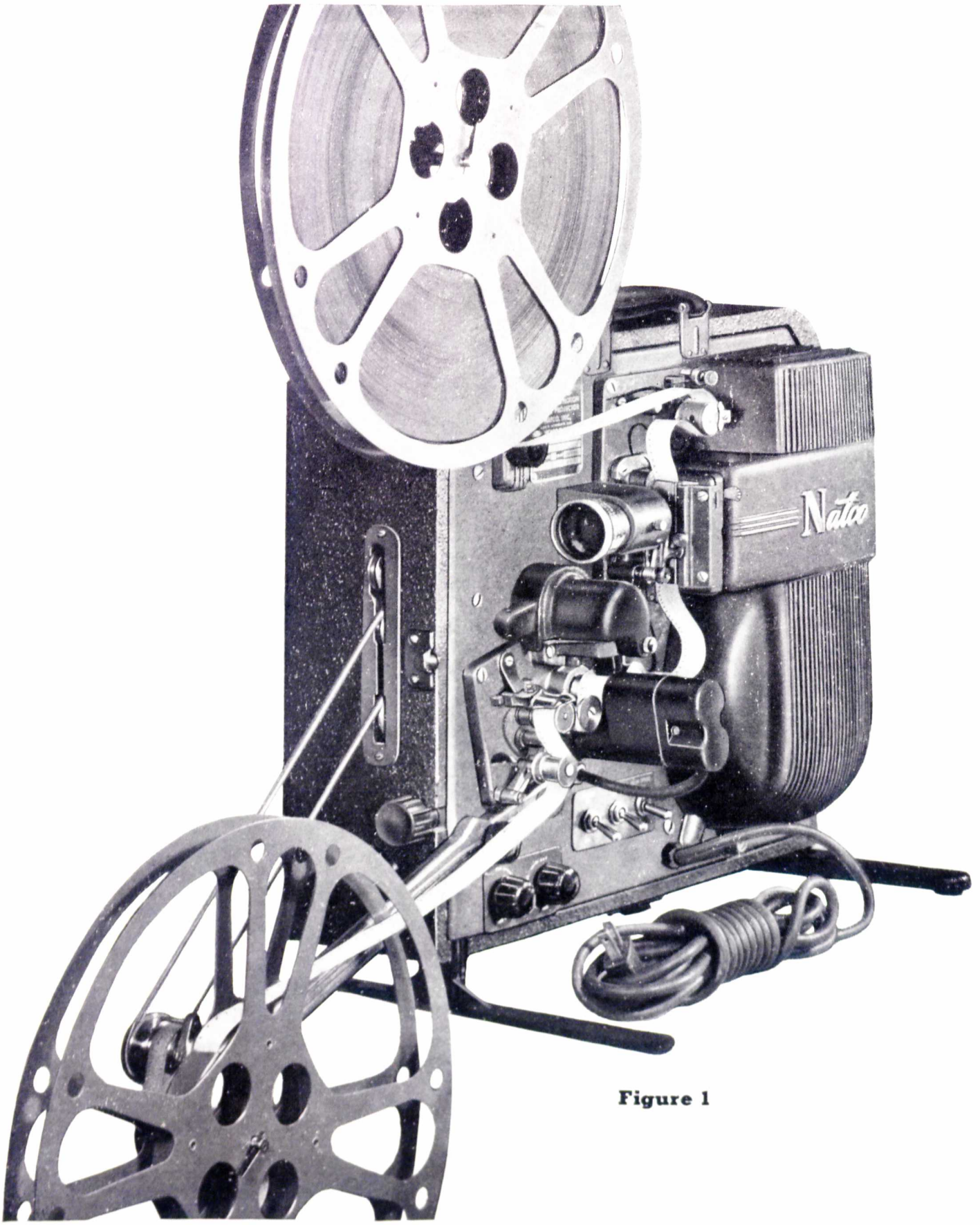


Figure 1

Natco

16 mm. SOUND FILM PROJECTOR

Your NATCO Projector

This booklet introduces your new projector. Every refinement that could possibly contribute to brilliant sound film reproduction has been included in this 16 mm. Projector. Engineered and built to meet professional standards, it features high fidelity performance combined with exceptionally sturdy construction. Various accessory equipment is available for further extending the capabilities of the projector, such as a complete range of projection lenses, versatile speaker and amplifier combinations of larger output, and microphone equipment for personal announcements.

You will wish to review the operation and threading of the projector, approved maintenance procedures, as well as the servicing of some of the common troubles associated with the operation of sound motion picture projectors. Please read the following sections relating to these topics carefully. They will help you to achieve "theater quality" projection, and long uninterrupted service.

In order to understand the operation of your projector it is necessary to know the functions and location of the various switches and controls.

Switches and Controls

The projection switches and controls, Fig. 2, comprise the following:

Motor Switch

The MOTOR switch turns the motor on and off. It is the main control switch because it is connected in series with the lamp switch and will also turn the projection lamp off.

Lamp Switch

The LAMP switch turns the projection lamp on and off, but not independently of the motor switch. The motor switch must be on in order to turn on the projection lamp.

Volume Control

The VOLUME control regulates the volume of sound from the loud speaker. The control should be set to approximately its center position when starting the projector. To increase the volume turn the control to the right.

Tone Control and Amplifier Switch

The TONE control regulates the tone quality of the sound reproduction. Set the control in the center position for average operation. To increase the bass response turn the control to the left, to increase the treble response turn the control to the right. To turn Amplifier on, turn tone control to right until a click is heard.

Sound-Silent Switch

The SOUND-SILENT switch selects the proper projector motor speed for sound or silent film operation. When the switch is in the sound position, film is projected at the rate of 24 frames per second. When the switch is in the silent position, film is projected at the rate of 16 frames per second.

Speaker Jack

The SPEAKER jack, Fig. 14, is located at the rear of the projector case. It receives the speaker cord plug.

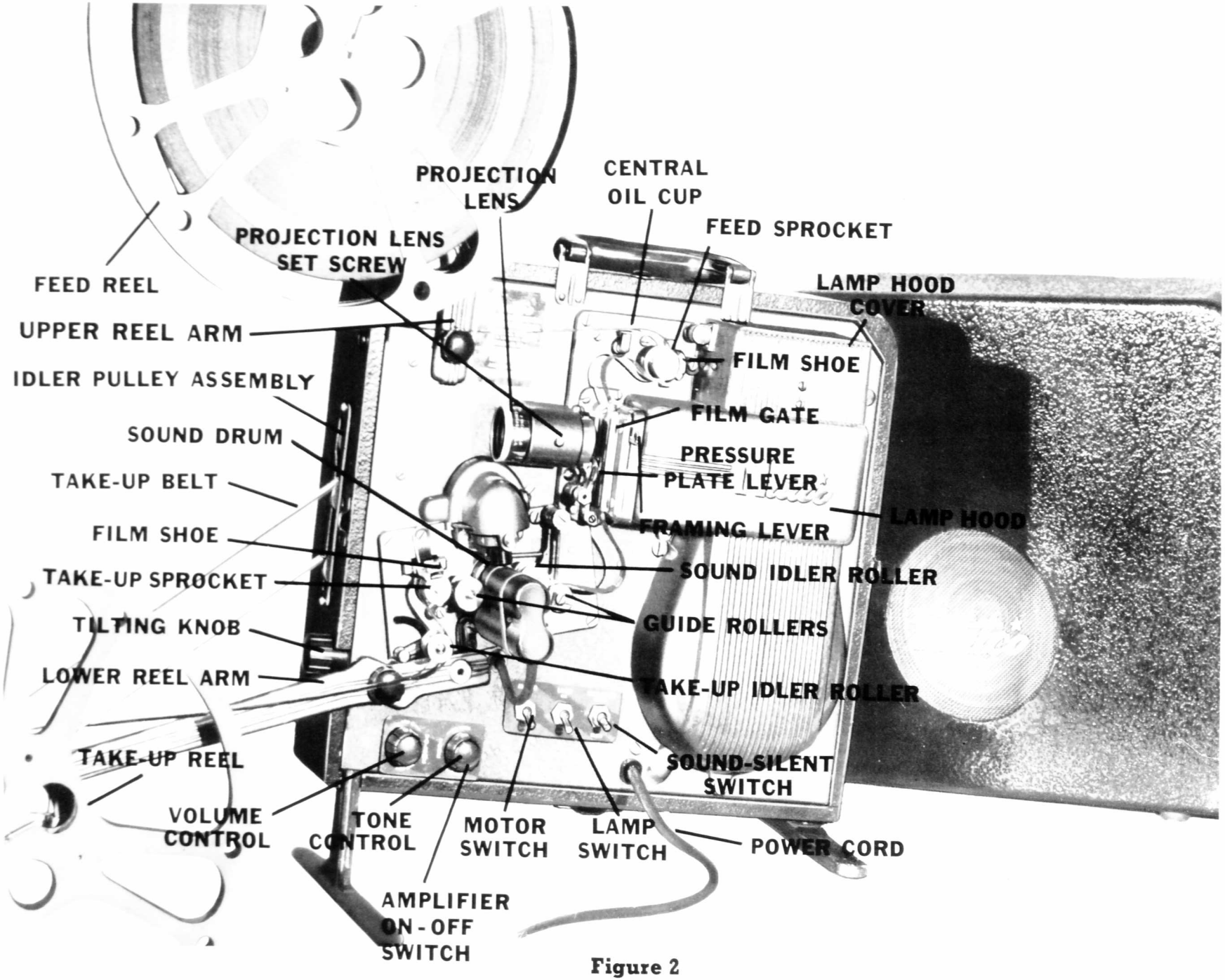

PROJECTION LENS
CENTRAL OIL CUP
FEED SPROCKET
PROJECTION LENS SET SCREW
FEED REEL
LAMP HOOD COVER
UPPER REEL ARM
FILM SHOE
IDLER PULLEY ASSEMBLY
FILM GATE
SOUND DRUM
PRESSURE PLATE LEVER
TAKE-UP BELT
LAMP HOOD
FRAMING LEVER
FILM SHOE
SOUND IDLER ROLLER
TAKE-UP SPROCKET
GUIDE ROLLERS
TILTING KNOB
LOWER REEL ARM
TAKE-UP IDLER ROLLER
TAKE-UP REEL
SOUND-SILENT SWITCH
VOLUME CONTROL
TONE CONTROL
MOTOR SWITCH
LAMP SWITCH
POWER CORD
AMPLIFIER ON-OFF SWITCH

Figure 2

Natco

OPERATING INSTRUCTIONS

Preparing to Operate your Projector for the First Time

Unpack Projector Carefully

Unpack the projector carefully making sure that no parts or accessories have been discarded with the packing material. Remove all paper and packing material that may have become attached to the projector, paying particular attention to the exposed parts of the projector mechanism, Fig. 2, such as film sprockets or the film gate in which bits of packing material may have become lodged. Read, follow the instructions, and then remove all caution tags attached to the projector.

Examine the projector cover, Fig. 13. In addition to the speaker, and the speaker cord, it should contain the upper and lower reel arms, a 400-foot take-up reel, and oil can.

It is advisable to carry the following spare parts in order to avoid delaying a scheduled performance due to failure of one or the other of these: Projection lamp, exciter lamp, spare set of amplifier tubes, set of Allen wrenches, and lens cleaning tissue.

Lubricate the Projector Before Using

Before using the projector for the first time the threading path and the projection lens should be cleaned as described in the Maintenance Instructions under "Regular Cleaning." The projector should be lubricated by filling the central oil cup with oil, waiting at least five minutes before operating the projector in order to permit thorough distribution of the oil.

Read Your Manual

It is prudent and conducive to long and satisfactory operation of the projector to thoroughly read the remainder of these "Operating Instructions" as well as the "Maintenance Instructions," before attempting to operate the projector.

Setting Up For Operation

Projection Stand

Select a substantial table or other rigid base upon which to place the projector. The screen should be placed at a sufficient height to permit the entire audience an unobstructed view. The projector should preferably be placed at somewhat more than ordinary table height in order to permit full screen coverage within the range of the projector tilting device, and to permit pointing the projector square to the screen. The projector should be placed close to the forward edge of the projection stand in order to permit the lower reel arm and take-up reel to clear the table.

Attaching the Reel Arms

Attach the lower reel arm to the projector, Fig. 2. Be sure the locating lugs are in their sockets, then securely tighten the attachment knob. Secure the upper reel arm in like manner. Pull the takeup belt out of the belt chute and run it over the lower reel arm pulley. Be sure that it engages the bottom and center idler pulleys located in front of the projector.

Note that the lower reel arm can be attached in either of two different positions by engaging the appropriate pair of locating recesses. In the lower depending position, the reel arm will accommodate a full 2000-foot reel. In the horizontal extending position, the arm will accommodate up to a 400-foot reel.

Power Supply

This projector may be operated from either alternating or direct current of any commercial frequency

at 105 to 125 volts. If you are not familiar with the power supply available for operating your projector, make sure that the voltage is as specified. An autotransformer capable of stepping down 230 volts alternating current to 115 volts can be purchased from your dealer.

The projector draws somewhat less than 1000 watts when operated with a 750-watt projection lamp. It is therefore important that the fuse in the power line be of at least 15 amperes capacity provided no other electrical equipment is on the same circuit, in which case the fuse should be correspondingly larger. When installing fuses of greater amperage to accommodate the projector, take care to replace them with the original fuses when the projection session is completed. Do not use an excessively large fuse because this projector is not fused internally and depends upon the power line fuse for safety.

Plug the projector power cord into the nearest available power outlet. The power outlet should be of adequate capacity to handle 10 amperes current. Temporary outlets of the type frequently installed to accommodate small lighting fixtures are not recommended. A heavy extension power cord may be used to reach distant power outlets. It is important that a heavy extension cord be used in order to avoid a large voltage drop in the extension cord. Now briefly test the operation of the projector. Turn on the MOTOR switch, but keep the LAMP switch turned off. The projector should run smoothly and quietly. Turn on the LAMP switch, a beam of light should emanate from the projection lens.

Setting Up the Speaker

Remove the speaker cord from the speaker and cover and place the speaker alongside of the screen, facing the center of the audience. It is desirable to elevate the speaker somewhat above the floor in order to realize most natural sound reproduction. Extend the speaker cord from the speaker to the projector and plug the speaker cord into the speaker jack. The projector may now be adjusted to the screen.

Adjusting the Projector to the Screen

Set the framing lever, Fig. 2, in approximately the center position of its normal range of adjustment. Loosen the projection lens set screw and focus the projection lens by turning it first in one direction and then in the other until the edges of the picture frame on the screen appear clear and sharp. Lock the projection lens set screw. Move the projector sidewise until the picture is centered laterally on the screen. Then loosen the knurled knob of the tilting device and raise or lower the projector until the picture is centered vertically on the screen. Lock the tilting device knob. If the projected frame of light is smaller than the screen, move the projector away from the screen. If it is larger than the screen move the projector closer. If the screen cannot be adequately covered with the standard 2-inch projection lens, it will be necessary to select a projection lens of proper focal length.

Projection Lenses

The following tables, Fig. 3, permits selection of the appropriate projection lens for various projection distances and to cover various screen sizes. Simply determine the desired distance of the projector from the screen in feet. Refer to this distance in the first column of the table, then carry over horizontally in the table until the approximate screen size to be covered is found. The focal length of the lens to give this screen size will be found at the top of the corresponding column.

The projector is now ready to operate. Turn off the motor and lamp switches and leave them off while threading the projector.

SIZE OF PICTURES OBTAINED WITH DIFFERENT PROJECTION LENSES AT VARIOUS DISTANCES

DISTANCE FROM SCREEN IN FEET	FOCAL LENGTH OF LENS IN INCHES						
	1	1½	2*	2½	3	3½	4
	SIZE OF PICTURE IN INCHES						
8	27 x 36	18 x 24	14 x 18				
10	34 x 46	23 x 30	17 x 23	14 x 18			
12	41 x 55	27 x 36	21 x 27	16 x 22	14 x 18	12 x 16	
15	51 x 68	34 x 46	26 x 34	21 x 27	17 x 23	15 x 20	13 x 17
18	62 x 82	41 x 55	31 x 41	25 x 33	21 x 27	18 x 23	15 x 21
25	86 x 114	57 x 76	43 x 57	34 x 46	29 x 38	24 x 33	21 x 29
36		82 x 109	62 x 82	49 x 66	41 x 55	35 x 47	31 x 41
50			86 x 114	68 x 91	57 x 76	49 x 65	43 x 57
75					86 x 114	73 x 98	64 x 86
100							86 x 114

** The 2-inch focal length lens is standard equipment for this projector. It is most satisfactory for average conditions. The above table may be used not only for determining the size of the picture obtained at various distances, but may also be used as a basis for selecting the screen and lens combination best suited to the projection distance available.*

Figure 3

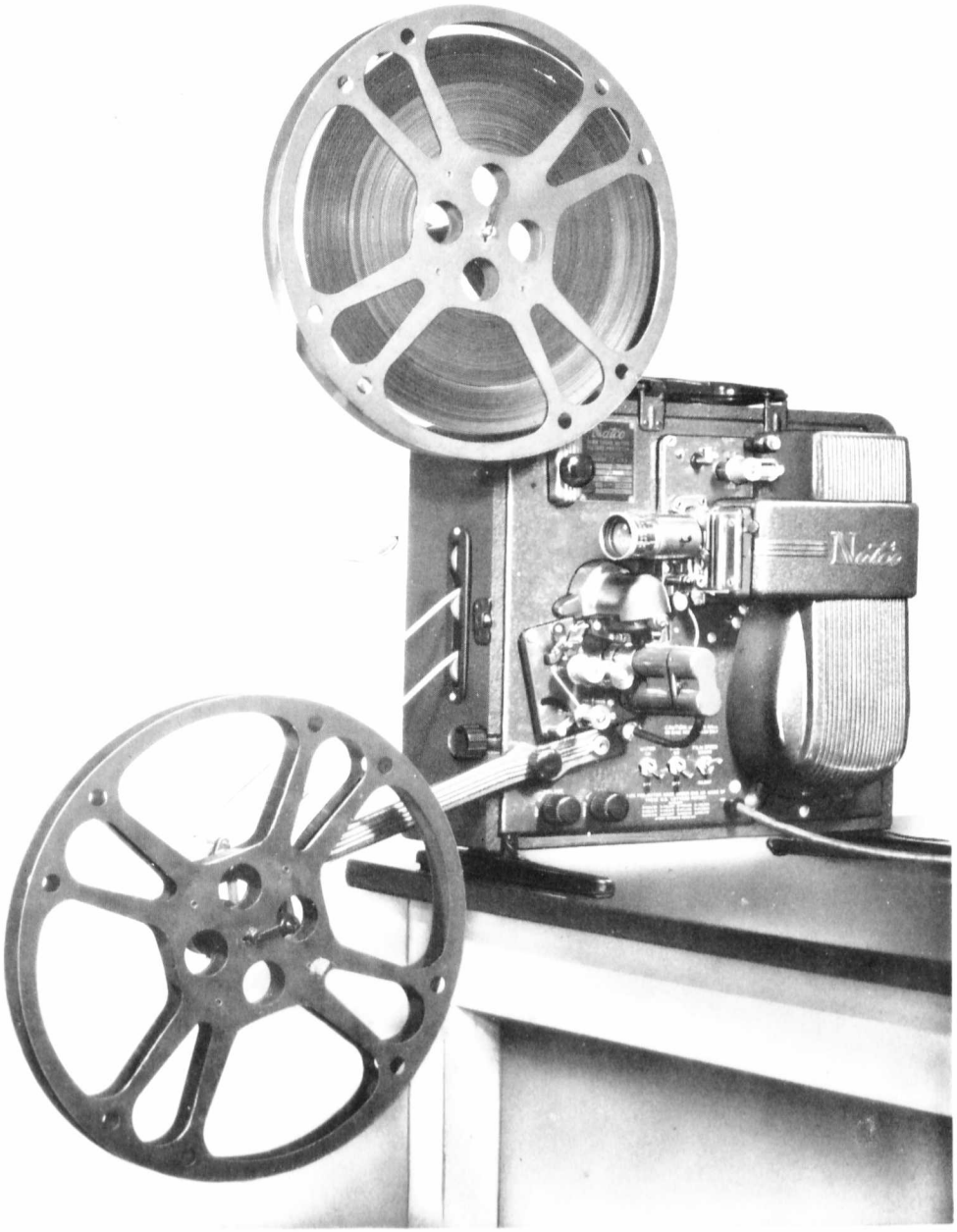


Figure 4

Threading the Projector

It is easy to thread the projector with film.

When the projector is fully set up and in operating condition, place an empty reel on the lower reel arm shaft with the slotted or square hole away from the projector. Latch the reel in place making certain that the latch engages the key slot or one corner of the square hole. The take-up reel must be large enough to receive all of the film on the feed reel.

Place a reel of film on the upper reel arm shaft with the slotted or square hole away from the projector and with the film perforations toward the projector. Latch the reel in place making certain that the latch engages the key slot or one corner of the square hole. If the film is correctly wound on the reel, the pictures on the film should be upside down as the loose end of the film falls from the reel, and the emulsion or dull side of the film should face the screen.

Open both film shoes and move the pressure plate lever, Fig. 2, to the left to open the film gate. Unwind about four feet of film from the reel.

Pass the film around the right of the top feed sprocket.

Adjust the film around the sprocket so that the sprocket teeth engage the film perforations, then close the film shoe.

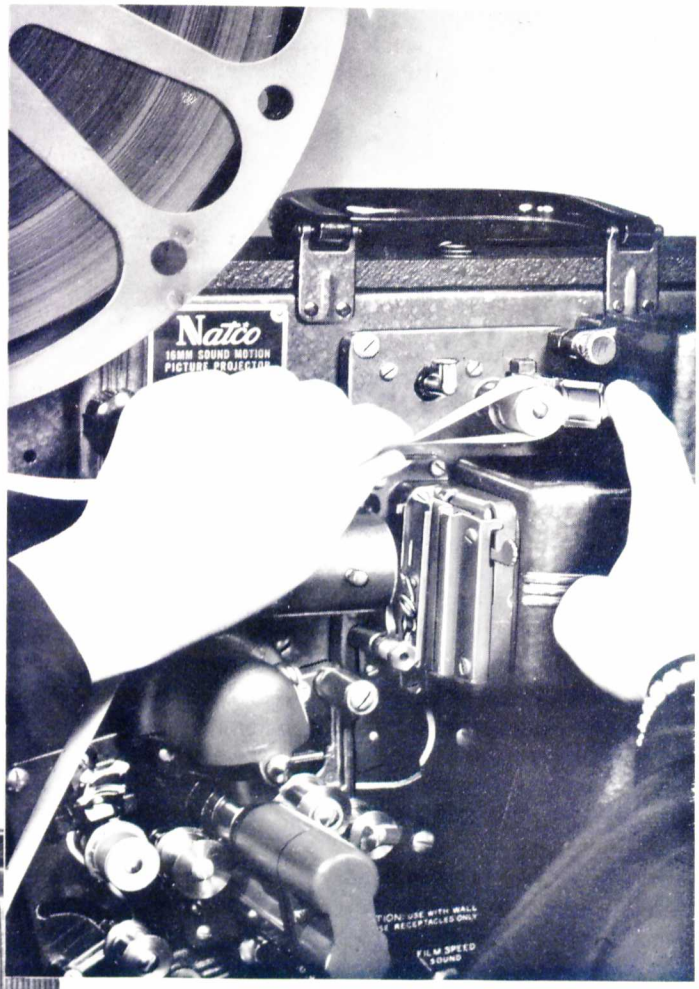


Figure 5

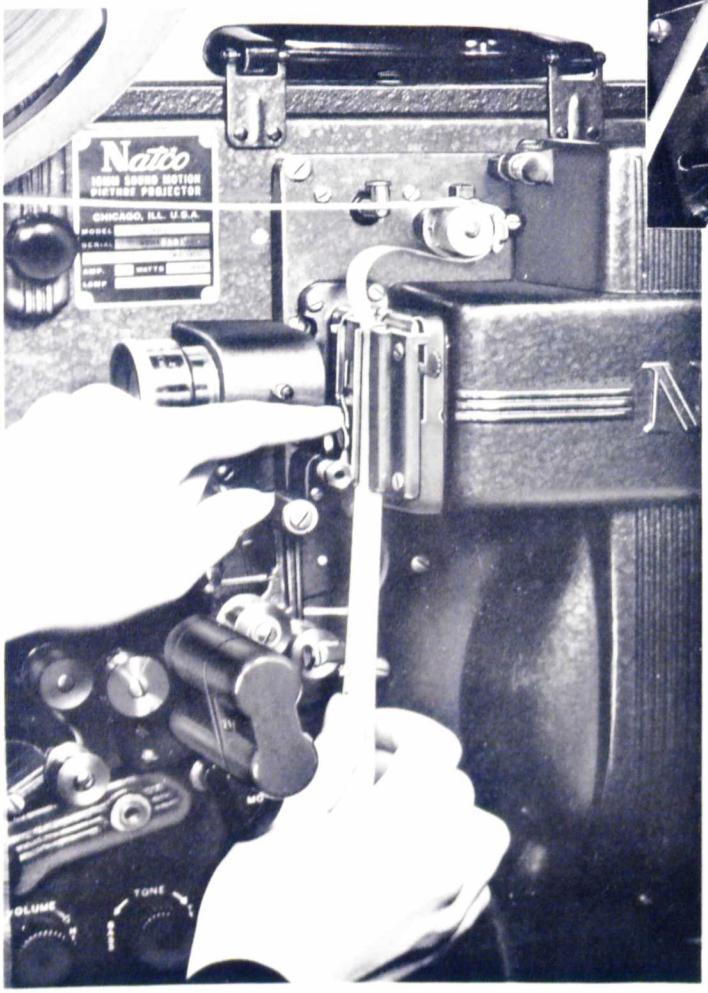
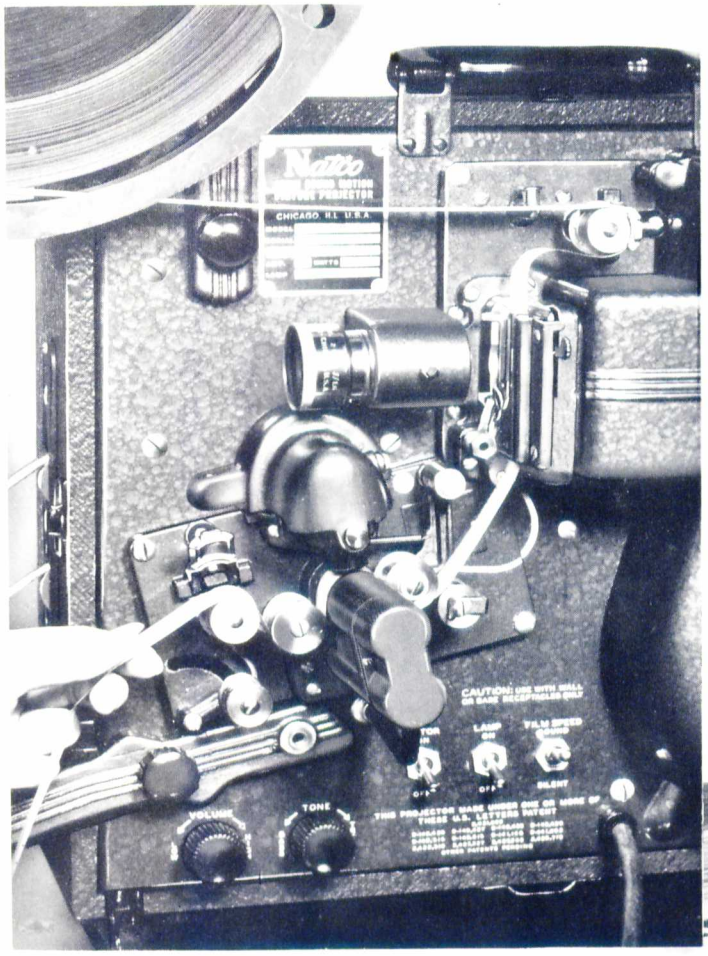


Figure 6

Place the film in the film gate leaving a loop of film approximately 10 frames or 3 inches long between the film gate and the upper feed sprocket.

Move the pressure plate lever to the right to close the film gate. Snap the "Motor" switch quickly on and off several times to permit the shuttle claws to engage the film perforations. Film should move down through the film gate when this is done.



Lead the film between the right guide roller and the sound idler roller, then under and around the left of the sound idler roller, then over the sound drum, then down between the fixed idler roller and the sound drum, up and around the fixed idler roller, and over the left take up sprocket.

Figure 7

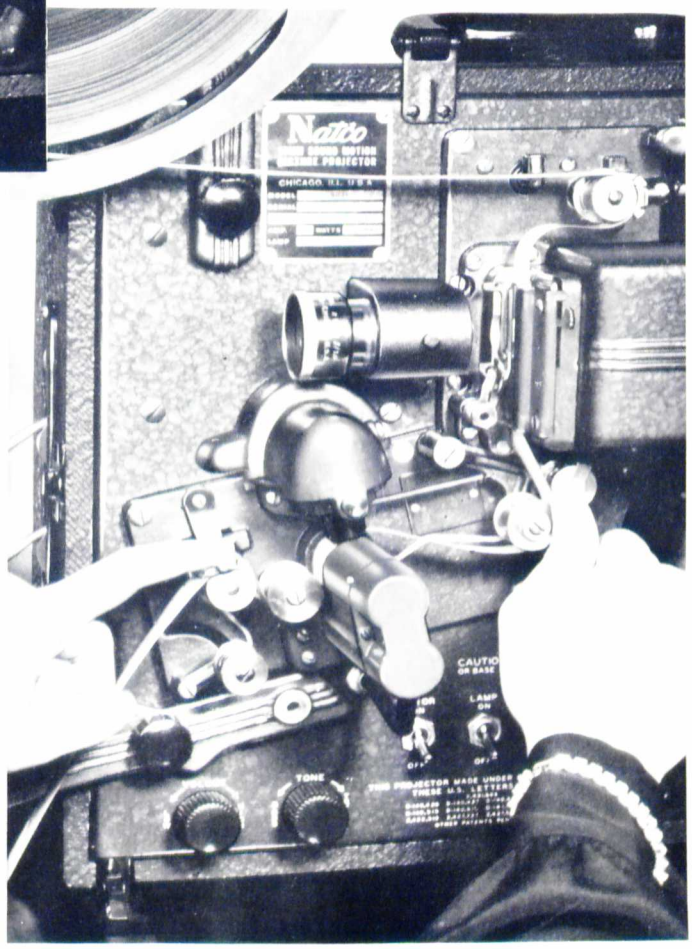


Figure 8

Retain film in the left hand and with the right hand form a loop which follows the contour of the threading line on the main front panel. Then close the film shoe.

This operation forms a loop between the sound drum and the picture aperture of the proper length for correctly synchronized sound.

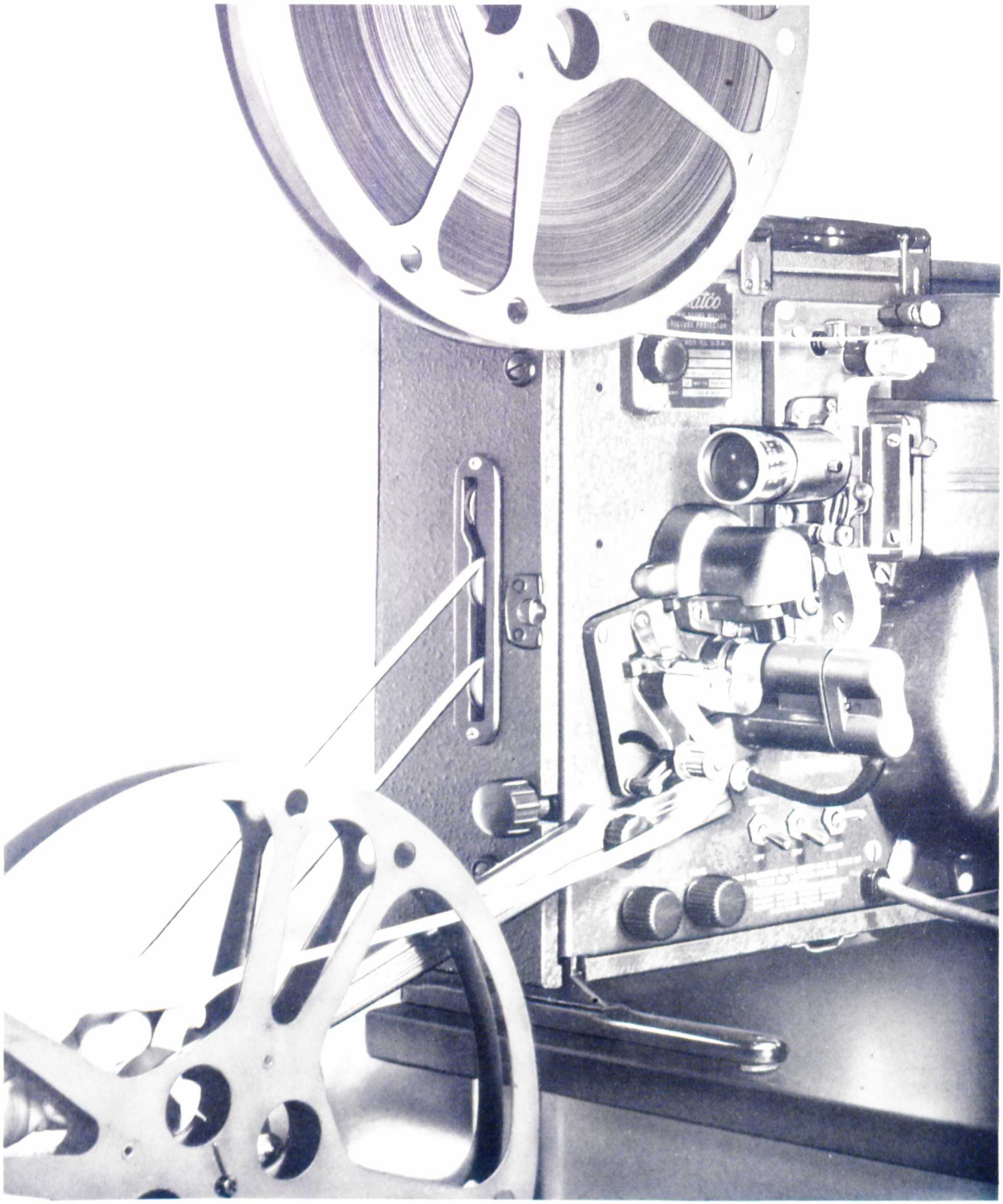


Figure 9

Pass the film under the take-up idler roller and insert the end of the film into the slot in the hub of the take-up reel. Turn the take-up reel to the left and take up the remaining film slack.

Briefly turn on the motor switch. If the film moves through the mechanism without strain and both loops are retained, the projector is properly threaded and is ready for operation.

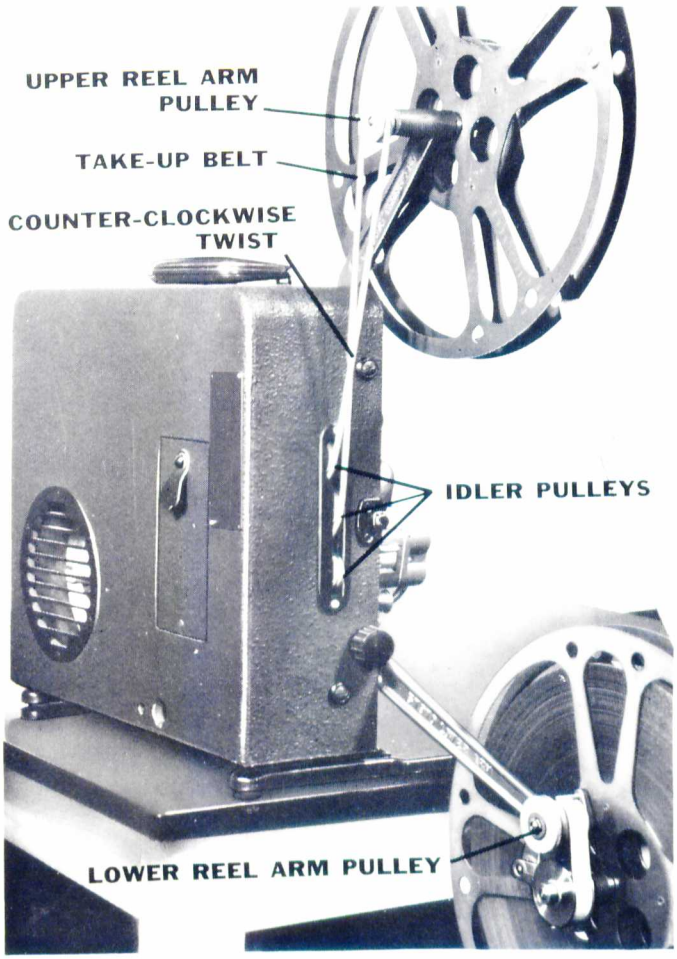


Figure 10

Operating the Projector

Turn on the motor switch and then the lamp switch. Caution: turn on the MOTOR switch before turning on the LAMP switch. Observe the screen and refocus the lens carefully first in one direction and then in the other, until the picture on the screen is crisp and sharp. Be sure to tighten the projection lens set screw so that the picture remains in focus. If the projected picture reveals a bottom or top frame line, or if part of the next frame can be seen adjacent to the top or bottom of the picture, adjust the framing lever slowly up or down from its center position until the frame lines disappear and a single full picture appears. This may cause a portion of the picture to appear off the screen, in which case the tilting device should be readjusted in order to center the picture on the screen.

Adjusting Sound

Turn on Amplifier (Switch on tone control, see Figure 2) allowing 30 seconds to warm up. Adjust the Sound-Silent Switch to the "Sound" position. Regulate the volume of sound by turning the volume control left or right until the desired sound level is reached. Adjust the tone control to the left for increased bass, or to the right for increased treble until a pleasing balance of sound is obtained. The center position of the tone control corresponds to approximately equal balance between bass and treble reproduction.

Silent Operation

If you wish to project silent films adjust the "Sound-Silent" switch to the "Silent" position. The speaker obviously does not have to be connected, unless it is desired to use a microphone for announcements, as described below.

To stop the performance at any time, simply turn off the motor switch. The projection lamp is controlled by the motor switch and is turned off at the same time, but the lamp switch should be turned off also. An amplifier switch has been incorporated on the tone control.

Rewinding

To rewind film remove the takeup belt from the lower reel arm pulley. Reverse the takeup belt by giving it a half twist in counter-clockwise direction as seen from in front of the projector, and place it over the upper reel arm pulley, Fig. 10. Make sure that the belt properly engages the top and center idler pulleys located at the front of the case. Remove the film from the threading path and lead the end of the film directly from the take-up reel to the feed reel. If the end of the film has left the feed reel, replace it on the feed reel and take up a few turns of film on the feed reel in the proper direction. Then turn on the motor switch and permit the film to rewind until all of it has been returned to the feed reel. When finished rewinding, return the takeup belt to its normal operating position.

When you have finished a projection session, protect the projector against dust and dirt so that no unnecessary cleaning will be necessary later. If the projector is to be used again soon and you wish to keep the installation ready for use, cover the projector with a dust cloth. If the projector is to be used again in a few hours, the power cord need not be disconnected.

Reassembling the Projector and Cover

To reassemble the projector installation, disconnect the power cord. Disconnect the speaker from the projector and coil the speaker cord in a loop of approximately 10" diameter. This loop will then flatten into a skein approximately 16" long and may then be placed under the retaining spring clip. Remove the upper and lower reel arms and secure them to their respective retaining blocks in the speaker case. One 400-foot reel may be carried in the speaker case. Coil the power cord in a similar manner to the speaker cord and place adjacent to the speaker cord under the retaining spring clip. The cover and speaker should now be placed over the main panel, and the catches fastened. Be sure all of the catches are fastened before picking up the projector.

Note

To insert take-up belt into machine, remove from take-up pulley and hold in left hand with a slight pressure. Turn on motor switch and belt will be retracted into belt chute. Turn off motor.

Using the Microphone and Other Accessories

A variety of accessories are and will be available further to extend the scope of your Sound Projector.

Microphone Amplifier

The Microphone Amplifier Unit Catalog No. 3036 is designed to receive the input from any high impedance microphone, when it is desired to use the projector as a public address system. This permits a running commentary to silent film, announcements to the audience, or the use of the projector installation as a straight public address system while film is not being shown. The Microphone Amplifier is furnished with suitable accessories for mounting inside the projector, and is connected to the projector amplifier by means of a simple plug-in arrangement. Two jacks accessible from the rear of the projector are marked "microphone" and "phonograph" respectively. Turn down the volume control when changing from sound track to microphone. The tone control operates alike for the microphone and for film.

The volume control on the microphone amp should be turned up less than half way for best results.

NOTE: Whenever this projector is to be operated on direct current, the microphone amplifier must be turned off by turning the slotted control to the left until a distinct click is heard.

Phonograph Pick-up

A phonograph pickup can be played through the microphone amplifier, furnishing incidental music for silent reels or during intermissions. Volume and tone controls operate for phonograph reproduction the same as they do for film. Occasionally the output voltage of phonographs exceeds the permissible input voltage to the projector amplifier, and distorted sound may be reproduced.

It is therefore advisable to install a simple netwc between the crystal pick-up arm of the phonograph and the phonograph plug-in cable to balance the phonograph output to the amplifier input. Consult your dealer before installing this network.

20-Watt Amplifier

For those demanding the ultimate in sound motion picture projection, there is available a special Speaker and Amplifier Unit Catalog No. 3048. See the parts listing in back of book. This unit includes a 12-inch speaker, a 20-Watt booster amplifier, and a 1600-foot reel. It is plugged into the projector like the smaller speakers, but its output is sufficient to operate two 12-inch speakers. An additional jack for the second speaker is provided.

Other Accessories

Additional accessories available for your projector are listed under "List of Accessories". For items of equipment listed there, see your dealer.

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MAINTENANCE INSTRUCTIONS

Your projector is a well constructed machine, however, its proper functioning depends not only on intelligent handling during operation, but also on routine maintenance. Accordingly, it is very important that certain routine practices be observed and made a habit in order to prolong the effective operational life of the projector and to guarantee pleasant uninterrupted performances.

Make a Habit of Regular Lubrication and Cleaning

Proper lubrication and scrupulous cleanliness are the two maintenance "musts" that should be strictly observed. Proper lubrication may prevent serious injury to many vital parts of the projector. The projector should be kept clean at all times. The film traveling along the threading path may deposit film emulsion at all points of contact and thereby hinder proper functioning of the machine. Similarly, dust or other foreign matter deposited on the light optical system will affect the brilliance of the projected image, and dust deposited on parts of the sound optical system will decrease or detrimentally affect sound output.

The rated life of the standard projection lamp is twenty-five hours. Many lamps will last much longer, but long before the lamp burns out, it begins to darken and its light output decreases substantially. Regular inspection will enable you to replace the lamp before an important projection session for which maximum brilliance is desired.

Gradual deterioration of tubes before they actually stop functioning will affect the quality of a performance. If poor sound quality is discernible, and all controls are properly turned on, it may be due to the deterioration of tubes. If operator of projector is fairly familiar with the function of the amplifier, he may replace such tubes as are deteriorated.

Regular Inspection

Regular inspection of the projector and watchful observation of its performance will detect such difficulties when they occur. A study of the table of "Trouble, Causes and Remedies" given in the "Servicing Instructions" will enable you to find and remedy the faults. These will not be frequent with regular maintenance.

Scheduled Lubrication

The object of proper lubrication is to maintain your projector in perfect operating condition. This object will be attained if the projector is lubricated according to a schedule, which should be made habitual.

When shipped from the factory, the projector is thoroughly lubricated. However, the lapse of time between this initial oiling and initial operation tends to reduce the oil supply. Similarly, infrequent operation of the projector throughout its lifetime — even after thorough oiling — tends to diminish oil supply. The following lubrication schedule is therefore based on length of operation of the projector, as well as on total length of service.

Lubricate Before Initial Operation

Before operating your projector for the first time, fill the central oil cup, Fig. 2, with special projector oil then wait five minutes before operating the projector in order to permit thorough distribution of the oil.

Lubricate After 8 Hours or Every Week

After 8 hours of operation or once a week, if the projector has not been used, refill the central oil cup with about four drops of projector oil.

Lubricate After 50 Hours of Operation or Every Month

After 50 hours of operation or once a month, if the projector has not been used, lubricate the guide and idler rollers, Fig. 2, with one drop of projector oil, then wipe off the excess oil.

Lubricate After 250 Hours of Operation or Every 6 Months

After 250 hours of operation or every six months, if the projector has not been used, apply a light coat of graphite grease to the upper and lower worm gears, Fig. 14. A tufted, long-handled brush will facilitate reaching these parts from rear case door.

Regular Cleaning

Cleaning of the projector, like lubrication, should be done on a regular schedule, which should be made habitual if optimum performance is desired. The projector should be thoroughly cleaned after 50 hours of operation. Some critical parts require cleaning prior to daily projection sessions. Failure to do so results in diminished light output and generally poor performance.

Clean the Projector Before Each Performance

Before each projection session, clean the threading path, aperture-plate, pressure plate, film sprocket, the guide and idler rollers, sound drum and sound idler roller, Figs. 11, 12. Use a soft, dry camel hair brush. Be especially careful to remove all lint and emulsion from the inside edges of the picture aperture in the aperture plate. These will show on the screen in greatly enlarged form as a fuzzy picture edge. The aperture and pressure plates can be dusted with the brush without removing them from the film gate.

Wipe dust from the front and rear lenses of the projector lens using lens tissue, absorbent cotton, or a clean, soft cotton handkerchief which has already been washed several times. Do not mistake the blue anti-reflection coating on the lens for oil haze.

Thoroughly Clean the Projector After 50 Hours of Operation

After the projector has been operated 50 hours, thoroughly clean the threading path and the light and sound optical systems.

Cleaning the Threading Path

Open the two film shoes and clean them thoroughly with a toothbrush dampened with carbon tetrachloride to remove caked film emulsion. Clean the sprockets in the same way. Clean the guide and idler rollers, the sound drum and the sound idler roller, Fig. 11, in like manner. Then thoroughly dry and polish these parts with clean lintless cloth or with lens tissue.

Move the pressure plate lever to the left to open film gate, Fig. 12. Press the framing lever to the right, out of its limited framing stroke, and move it down until it stops. This releases the aperture plate. Lift up and remove the pressure plate, and lift out the aperture plate. Leave the framing lever in this position until aperture plate is cleaned and ready to be reinserted. Clean all surfaces, and especially the inner edges of the picture aperture, thoroughly with carbon tetrachloride to remove caked emulsion residue. Thoroughly dry and polish all parts with a dry lintless cloth or lens tissue. To replace the aperture plate, slip it back into position and while pressing plate down, lift the framing lever until it snaps back into its limited framing stroke. Then replace the pressure plate.

Cleaning Projection Optical System

Wait until the projector has cooled before attempting to clean the projection optical system.

Removing the Lamp Hood

Loosen the two lamp hood cover thumbscrews and remove the cover. Remove the four screws which hold the lamp hood to the main panel. This exposes the optical system, Fig. 12, of the projector. Do not turn on the motor when the lamphouse is dismounted. If it is intended merely to replace the projection lamp, the lamp hood need not be dismounted.

Cleaning and Replacing the Projection Lamp

Remove the projection lamp by pressing down upon it and twisting it to the left. A little force may be required to do this. Examine the lamp. If it is turning black or if the filaments are sagging, replace it with a new lamp. Replace the projection lamp with one of the proper voltage rating. If possible, obtain a measurement of the voltage at your power outlet when the projector is running. Then select a lamp voltage within five volts of the measured voltage. A slightly higher lamp voltage rating extends the lamp life. A slightly lower lamp voltage rating increases the light output.

If the lamp is still usable, clean it with lens cleaning fluid, then wipe it dry with a soft lintless cloth or with lens tissue. Before replacing the projection lamp, clean the aspheric lens and the reflector.

Reflector

Pull back the reflector retaining spring and remove the reflector, Fig. 12, by pushing the reflector out of its socket. The fingers should be covered with a piece of lens tissue or a soft clean handkerchief to avoid smudging the reflector while doing this. Clean the reflector with absorbent cotton dampened with Lens Cleaning Fluid. Thoroughly dry and polish it with lens tissue or absorbent cotton. To replace the reflector, grasp it by the edges and slip it back into its socket. Now remove and clean the aspheric lens.

Aspheric Lens

To extract the aspheric lens, push it forward in its socket, against the pressure of the coiled retaining spring, then up and out of the socket. Clean the lens with absorbent cotton dampened with Lens Cleaning Fluid, then thoroughly dry and polish the lens with lens tissue or lintless cotton material.

Biconvex Lens

Clean the biconvex lens in like manner. It is not necessary to remove this lens from its mount in order to clean it.

Now replace the projection lamp. Make sure that it is properly seated in its socket.

Projection Lens

Remove and carefully clean the projection lens. Dry and polish the surfaces of this lens carefully so as not to scratch the blue coated surfaces. They are delicate and their sheen must not be mistaken for oil haze.

Cleaning the Sound Optical System

Carefully clean the sound optical system, Fig. 11. Remove the exciter lamp hood by loosening the thumb-screw in front, and carefully pulling the hood forward disengaging the four prong plug. NOTE: Exciter lamp will not go "on" while hood is removed. If necessary clean the threading light jewel on the hood.

Pull the exciter lamp shield off the exciter lamp. Examine the lamp for discolorations and a sagging filament. The filament should be straight. If either condition is observed, replace the lamp. Install a new lamp by engaging the socket lugs with the corresponding lamp base slots and twisting the lamp to the right until the lugs snap into place. Note that the two lugs closest together are on top. To remove the exciter lamp, twist it to the left to disengage the socket lugs from the slots in the exciter lamp base. Clean the exciter lamp with lens cleaning fluid. Dry and polish it with lens tissue.

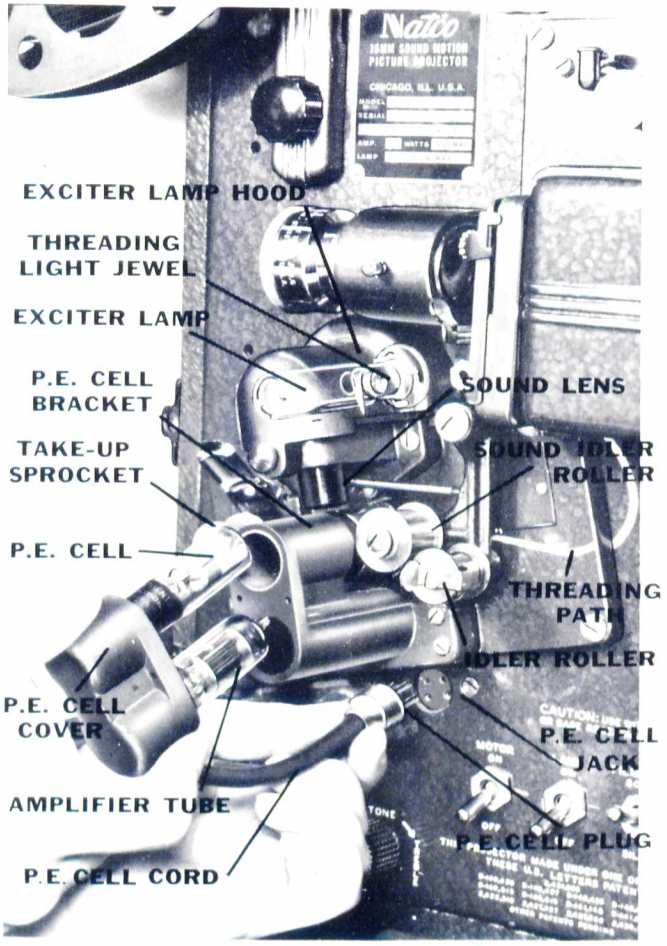


Figure 11

Cleaning the Sound Lens

Clean the top and bottom lens elements of the sound lens with lens tissue wrapped around a toothpick and dampened with lens cleaning fluid. If absorbent cotton is used, carefully remove any fibers that might remain on the lens. Do not use an excess of Lens Cleaning Fluid. Under no circumstances attempt to remove the sound lens from its holder. Only an expert can properly adjust it. Now replace the exciter lamp shield in its original position. Make sure the round threading light aperture in the shield is adjacent to the threading light jewel. Replace the exciter lamp hood and secure the thumbscrew.

Cleaning the Photo-Electric Cell

Remove the two small screws holding the Photo-Electric cell cover. Pull out the Photo Cell cord plug from socket in front of panel. Gently pull out the cover, Fig. 11, and the photo-electric cell and amplifier tube along with it. Dirt and dust on the cell

surface reduce the cell sensitivity.

CAUTION! Read the following information concerning Photo Electric Cells

Photo Electric Cells, when exposed to fluorescent lighting of any intensity, will paralyze or desensitize for long periods of time. Most Photo Electric Cells will not recover from this desensitation. Photo Electric Cells, if exposed to a high intensity of incandescent light, will be temporarily desensitized. Most cells will recover from this desensitation after some hours in a dark storage place. Some cells will never entirely recover their original sensitivity, therefore, whenever removing the Photo Electric Cell, care should be taken not to expose the cell as outlined above.

Clean the cell with lens tissue or a soft clean cloth. Clean the inside of the cavities in the P.E. cell bracket. Make sure there is no dust or lint in the small aperture directly beneath the sound lens, which would keep the light beam from the sound lens from reaching the P.E. cell. Replace the P.E. cell cover. Make sure the P.E. cell cord is plugged into the jack on the panel. It is necessary to disconnect this cord, when removing the cover.

Although lubrication and cleaning procedures have been described separately, lubrication and cleaning can and should be done together at regular intervals. Excessive cleaning and oiling are not advisable, however. It is good practice to keep the projector covered except when it is actually being used in order to keep out unnecessary dust. A fine instrument deserves good care.

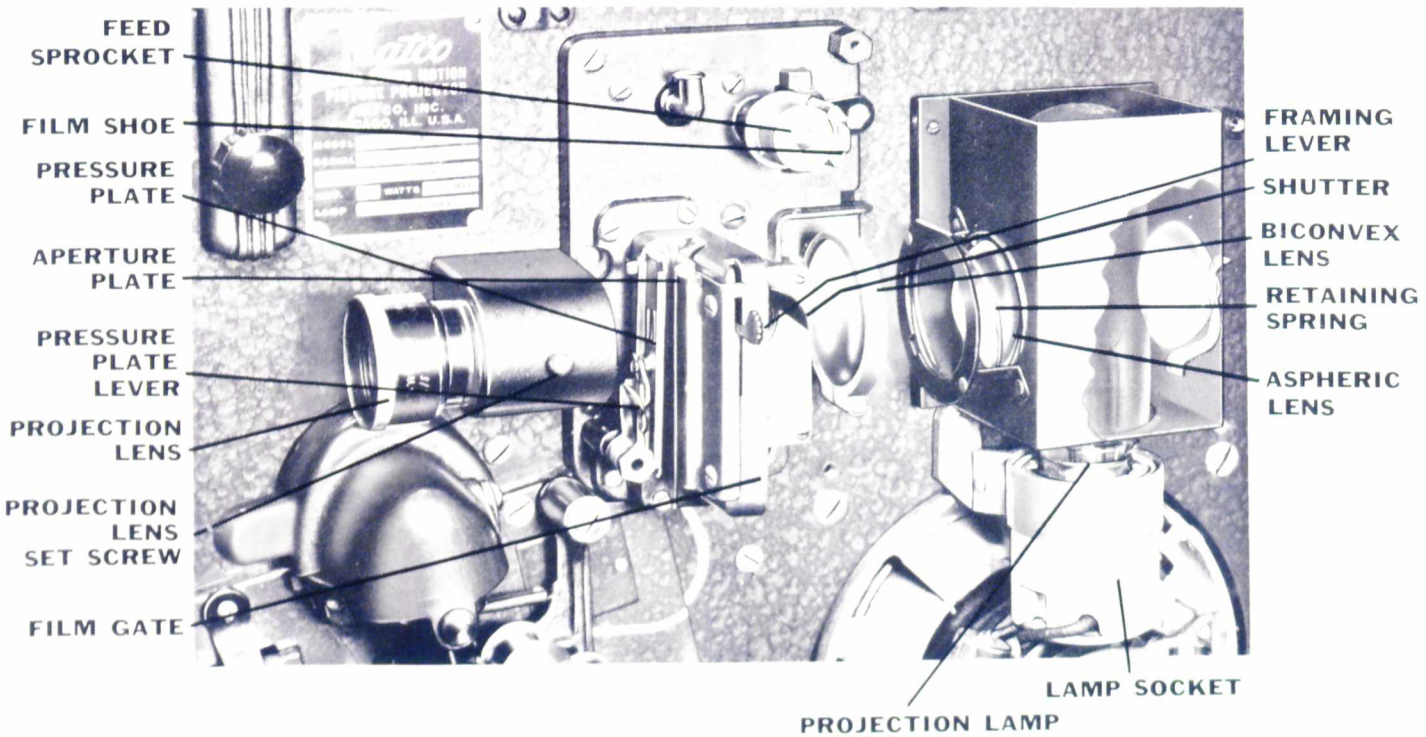


Figure 12

Natco

SERVICING INSTRUCTIONS

Locate Troubles Systematically Using the Table

Your Sound Film Projector is a complex mechanical and electronic instrument, and may occasionally require attention to correct troubles that develop. So that you may quickly and systematically locate any ordinary trouble that might occur, there follows a "Table of Troubles, Causes and Remedies."

Do Not Attempt Adjustments Not Described Herein

The following instructions are intended to cover only those services which can be performed by relatively unskilled persons. It should be noted, however, that not all troubles will respond to these remedies, and projectionists are cautioned against experimenting with remedies of their own unless they are fully qualified to do so. When none of the suggested remedies, attempted in the order given, eliminates the trouble it may be advisable to return the projector to your dealer or other authorized service station for a complete checkup. Any replacement which may be needed and for which instructions are not outlined herein, requires the skill and experience of the manufacturer's service experts or his authorized service representatives.

Projector parts are precision-built, rigidly inspected and laboratory tested to insure trouble-free operation. If servicing should ever be required, this machine's ingenious unit assembly and sub-assembly principle of design permits quick, easy removal of any part of the projector for replacement by a service station "loaner" assembly while repair is made.

Table of Troubles, Causes and Remedies

Trouble	*Possible Cause*	*Remedy*
1. Motor inoperative	a. Power source dead, or power fuses burned out.	a. Check power or source.
	b. Open circuit in power cord.	b. Replace cord, making certain that replacement is identical with original, or of equal capacity.
	c. Jammed picture mechanism.	c. Return projector to authorized service station for repair.
	d. Motor defective.	d. Return projector to authorized service station for repair.

Table of Troubles, Causes and Remedies

Trouble	*Possible Cause*	*Remedy*
2. Loss of lower film loop.	a. Broken sprocket holes in film.	a. Remove film from projector; cut out section with broken sprocket holes, and splice film.
	b. Take-up sprocket shoe fits too loosely, causing film to jump off sprocket teeth.	b. Return projector to authorized service station.
	c. Film binding in gate, due to thick splice.	c. Make new splice.
	d. Film gate assembly housing has shifted to left and shuttle claws fail to engage film.	d. Return projector to authorized service station.
3. Loss of upper film loop.	a. Insufficient tension of spring against pressure plate.	a. Return projector to authorized service station.
4. Loss of both film loops.	a. Feed sprocket shoe fits too loosely, causing film to jump sprocket teeth.	a. Return projector to authorized service station.
5. Scratches on film.	a. Accumulation of film emulsion, dirt or dust on guide and idler rollers, aperture plate, pressure plate, sprockets, film shoes, and sound drum.	a. Clean all affected parts.
	b. Guide and idler rollers are binding.	b. Return projector to authorized service station for inspection.
	c. Nicks and scratches on contact surfaces of film path — guide and idler rollers, sound drum, contact roller, pressure plate, aperture plate, and sprockets.	c. Return projector to authorized service station for inspection and replacement of parts.
6. Excessive film wear.	a. Film shoes fit too snugly around sprockets.	a. Return projector to authorized service station for adjustment.
	b. Excessive tension of spring against pressure plate.	b. Return projector to authorized service station for adjustment.
7. Torn or damaged film splices.	a. Film shoes fit too snugly around sprockets.	a. Return projector to authorized service station for adjustment.

Table of Troubles, Causes and Remedies

Trouble	*Possible Cause*	*Remedy*
8. Damaged or torn perforations.	a. Excessive tension of spring against pressure plate.	a. Return projector to authorized service station for adjustment.
	b. Film sprocket teeth badly worn.	b. Examine all sprocket teeth for undercut surfaces. Return projector to authorized service station for replacement of sprocket.
	c. Worn or damaged shuttle claws.	c. Return projector to authorized service station for replacement of shuttle.
9. Excessively noisy projector operation.	a. Film slap resulting from improper tension of spring against pressure plate.	a. Return projector to authorized service station for adjustment.
	b. Film clicking resulting from badly worn sprocket teeth or shuttle claws.	b. Return projector to authorized service station for replacement of parts.
	c. Inherent mechanical noise.	c. Return projector to authorized service station for repair.
10. Projector running but no picture on screen.	a. Projection lamp burned out.	a. Replace projection lamp.
11. Insufficient picture brilliance.	a. Outside light falling on projection screen.	a. Trace source of light and eliminate it.
	b. Blackened projection lamp.	b. Replace lamp.
	c. Dirty projection optical system.	c. Clean projection optical system.
	d. Low power line voltage or wrong lamp voltage rating.	d. Check voltage and, if incorrect, change lamps or seek proper supply.
12. Fuzzy border line on screen.	a. Accumulation of dust or emulsion on aperture and pressure plates.	a. Clean both parts.
13. Color on screen or uneven distribution of light.	a. Accumulation of dust or other foreign matter on lenses, or reflector.	a. Clean projection optical system.
	b. Projection optical system out of adjustment.	b. Return projector to authorized service station for adjustment.

Table of Troubles, Causes and Remedies

Trouble	*Possible Cause*	*Remedy*
14. Vertical lines observed on screen.	a. "Travel Ghost" caused by shutter being out of timing with intermittent movement.	a. Return projector to authorized service station for adjustment.
15. Picture jumping on screen.	a. Improper tension of spring against pressure plate.	a. Return projector to authorized service station for adjustment.
16. No sound.	a. Volume control not advanced.	a. Turn volume control to right, as desired.
	b. Speaker cable not fully connected to Speaker Jack.	b. Make proper connection.
	c. Photo-electric cell cord not connected to amplifier.	c. Make proper connection.
	d. Exciter lamp burned out.	d. Replace exciter lamp.
	e. Tubes may need replacement.	e. Have tubes checked. Replace deteriorated tubes.
	f. Sound and silent switch turned to silent.	f. Turn switch to sound speed.
	g. Exciter lamp shield turned.	g. Straighten shield so that light can pass to sound optics lens.
17. Low sound volume.	a. Volume control not sufficiently advanced.	a. Turn volume control to right, to desired intensity.
	b. Discolored exciter lamp or sagging lamp filament.	b. Replace lamp.
	c. Dust or emulsion accumulated on surfaces of sound lens.	c. Clean lens.
	d. Emulsion and dust accumulation on photoelectric cell.	d. Clean Photoelectric cell.
	e. Low power line voltage.	e. Check voltage and if incorrect change to proper source of power.
	f. Tubes may need replacement.	f. Have tubes checked. Replace defective tubes.
	g. Photoelectric cell may need replacement.	g. Have photoelectric cell checked. Replace if defective.
18. Distorted sound reproduction. Sound is wavy or wows.	a. Dirty sound drum, sound idler roller, sprockets or dirty or torn film.	a. Clean affected parts. Inspect film.
	b. Damaged or badly worn sound drum, sound idler roller, idler rollers, sprockets, or sound drum bearings.	b. Return projector to authorized service station for replacement of damaged parts.

Table of Troubles, Causes and Remedies

Trouble	*Possible Cause*	*Remedy*
	c. Tubes may need replacement.	c. Have tubes checked. Replace defective tubes.
	d. Photoelectric cell may need replacement.	d. Have photoelectric cell checked. Replace if defective.
	e. Improper sound idler roller friction adjustment.	e. Return projector to authorized service station for adjustment.
19. Noisy Sound.	a. Arcing at governor contacts.	a. Return projector to authorized service station for repair.
	b. Defective wiring.	b. Return projector to authorized service station for repair.
20. Troubles not covered in this list.	a. Cause must be systematically determined by experienced service man.	a. Do not experiment with remedies. Return projector to authorized service station for repairs.
21. Broken Plastic Belt	a. Undue strain	a. Replace. Remove the rear inspection door. Remove the front idler assembly which is held in place by two screws. Remove center idler pulley and insert plastic belt. Replace center idler pulley in idler pulley assembly. Replace idler pulley assembly on projector. Loosen the set screw in the collar which holds the drive shaft in place. The collar will then slide down and the drive shaft will separate. The plastic belt may then be placed around the drive pulley. Place the two ends of the drive shaft together, slide the collar into its previous position and tighten set screw. Replace inspection door.

Natco

LIST OF ACCESSORIES

The following list includes accessories and replacement parts for your 16 mm. Sound Projector. They are available from your dealer.

Consult your dealer or authorized service station before attempting the repair or replacement of other parts.

Part Name	*Cat. No.*
Microphone Amplifier	3036
12-inch Speaker Unit, with 20-watt Amplifier, complete with case	3048
Speaker Cable Extensions	
25-foot	3061-1
50-foot	3061-2
Power Cable Extensions	
15-foot	3056-15
30-foot	3056-30
Auto-transformer	
200-230 volts A.C. to 115 volts, 1-KVA rating	3064
Projection Lenses, 16 mm. coated	
1 -in. E.F. f/2.0	50240-1
1½-in. E.F. f/1.65	50240-1½
2 -in. E.F. f/1.6	50240-2
2½-in. E.F. f/1.85	50240-2½
3 -in. E.F. f/2.0	50240-3
3½-in. E.F. f/2.5	50240-3½
4 -in. E.F. f/2.8	50240-4

Part Name	*Cat. No.*
Projection Lamps, med. prefocused	
750 watts 105-volts, 25 hour	3080-52
750 watts 110-volts, 25 hour	3080-53
750 watts 115-volts, 25 hour	3080-54
750 watts 120-volts, 25 hour	3080-55
1000 watts 105-volts, 25 hour	3080-67
1000 watts 110-volts, 25 hour	3080-68
1000 watts 115-volts, 25 hour	3080-69
1000 watts 120-volts, 25 hour	3080-70
1000 watts 105-volts, 10 hour	3080-72
1000 watts 110-volts, 10 hour	3080-73
1000 watts 115-volts, 10 hour	3080-74
1000 watts 120-volts, 10 hour	3080-75
Exciter Lamp, 7-volt, 0.2 ampere	56902
Photoelectric cell, cetron CE-25-C	50544
Amplifier Tubes	
12 SL7-GT	73640-16-1
50 L6-GT	73640-17-1
6 C4	73640-18-1
12AU7	73640-19-1
Reels, film, 16 mm.	
1600-foot	50045
Lens Tissue, book	50683
Projector Oil	
2-oz. bottle	3060-2
8-oz. bottle	3060-8
16-oz. bottle	3060-16

see back cover for illustrations of Natco Accessories

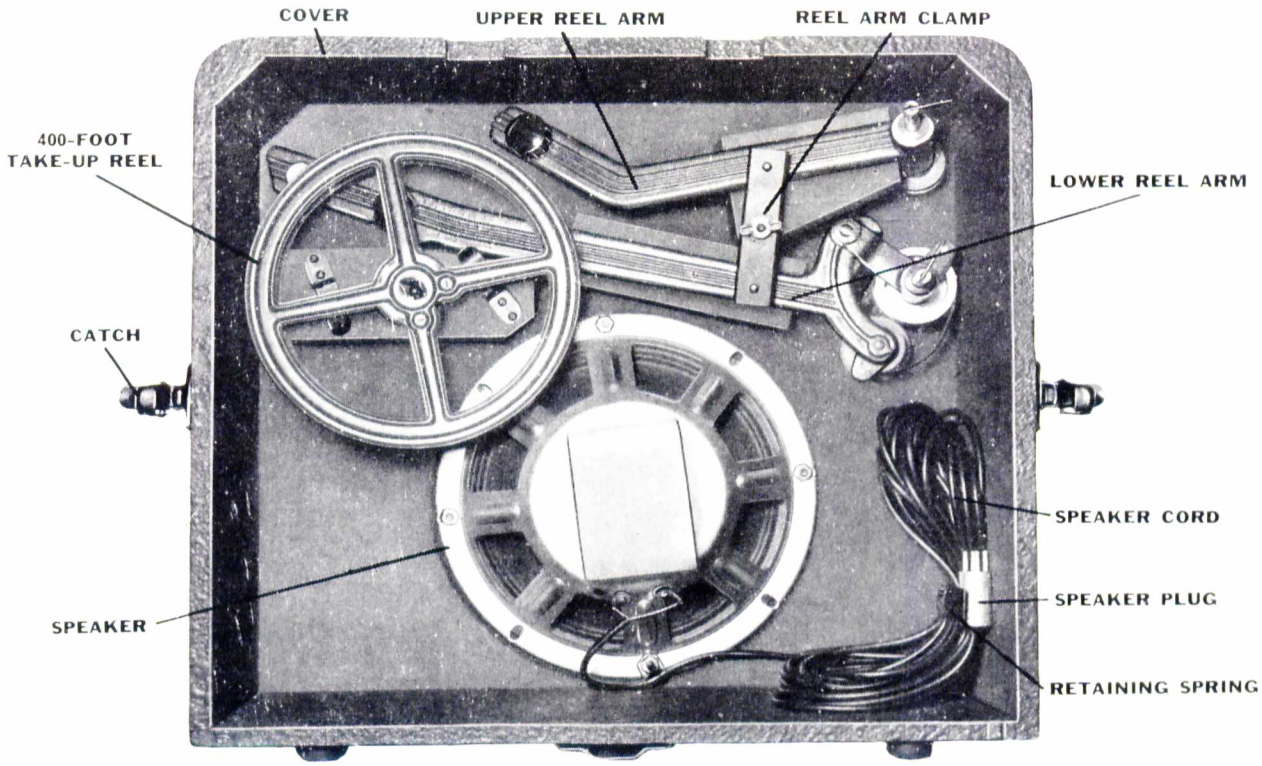


Figure 13

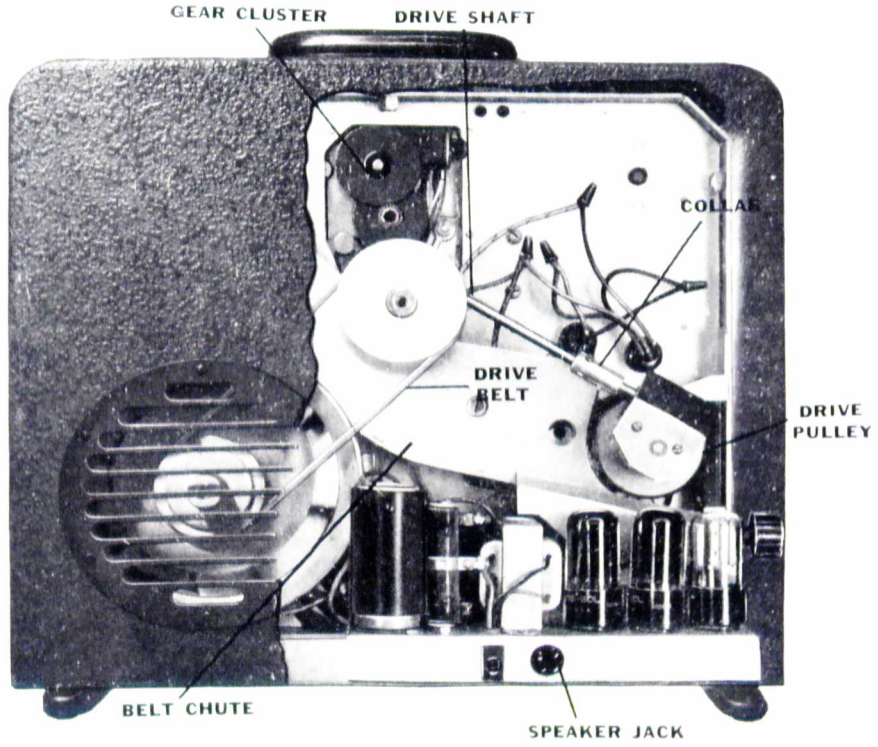


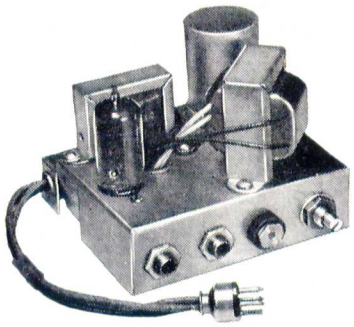
Figure 14

Natco accessories for your 16 mm. sound projector

BOOSTER AMPLIFIER

No. 3048

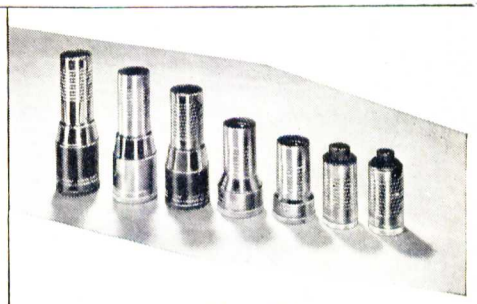
For use with Model 3030 Natco. Twelve inch speaker and twenty watt AC amplifier in portable case. Finish matches the Natco 3030. Gives auditorium coverage.



MICROPHONE AMPLIFIER

No. 3036

For use with the model 3030 Natco. Two inputs, one for microphone, one for turntable, built in control. Permits fading from sound track to mike or phonograph. Easily installed, no wires to connect.



PROJECTOR LENSES

All Lenses are Coated

50240-1	1" F 2
50240-1½	1½" F 1.65
50240-2	2" F 1.6
50240-2½	2½" F 1.85
50240-3	3" F 2
50240-3½	3½" F 2.5
50240-4	4" F 2.8

TURNTABLES

No. 3461—SINGLE SPEED TURNTABLE

Metal case, wrinkle finish case, lite weight built in mic input and volume control

No. 3462—DUAL SPEED TURNTABLE

Cased as above, 33⅓ and 78 RPM, feathertouch arm

No. 3461-50—Single Speed Turntable, 50 cycle

No. 3461-20—Single Speed Turntable, 50 cycle, 220 Volt

DUAL TURNTABLE

No. 3463

All metal case, two tables, single speed, Hammerloid finish.

TWO AND THREE WAY MIXERS

No. 3470—TWO WAY MIXER

No. 3471—THREE WAY MIXER

Allows for the use of additional microphones or turntables with separate controls to fade one to another.

PROJECTOR COVERS

NATCO 16MM SOUND PROJECTOR

3487-1 } *set for Model 3015*
3487-2 }

3488, Black *for Model 3030*

Leatherette tailored to fit. Slip-over type.

VOLTAGE BOOSTER

No. 3037

Maximum load 1500 volt amperes. Normal voltage range 85 to 120 volts AC 50 or 60 cycles

Permits perfect projection in low voltage areas taking as low as 85 volts up to 115 volts

MICROPHONES AND STANDS

No. 3452

Crystal microphone high fidelity, low price. Hand and desk type combined, interlocking base. Opalescent tan finish. Seven and a half foot shielded microphone cable.

No. 3453

Dynamic microphone, tilting head. Beautiful chrome type finish. Smooth high level dynamic cartridge, level-54DB. Range 40-10000 cycles. Complete with twenty foot cable, high impedance.

No. 3475—Natco microphone floor stand

Thirty-eight inches to sixty-eight inches adjustable chrome center pipe.

No. 3455

6" Brush chrome table stand

Natco world's finest 16mm. professional sound film projector

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